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I, JANENE PEISKER, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003903320 for a patent by JIONG LYENA LI as filed on 27 June 2003.

WITNESS my hand this
Seventeenth day of November 2003

JANENE PEISKER
TEAM LEADER EXAMINATION
SUPPORT AND SALES

AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Applicant(s):

JIONG LYENA LI

Invention Title:

A CAR PARK

The invention is described in the following statement:

A CAR PARK

FIELD OF THE INVENTION

The present invention relates to a car park or parking garage, and to a storage facility.

BACKGROUND OF THE INVENTION

Existing multilevel car parks provide multiple parking compartments or platforms, each generally accessible by means of a sequence of ramps joining each level. The ramps may be essentially straight or, in some existing car parks, spiral. The ramps, however, consume a substantial amount of space that ideally would be devoted to parking compartments.

This problem has been addressed in some existing car parks by providing a multilevel car park with one or more hoists, for transporting the cars to the parking compartments. This reduces or eliminates the need for ramps. For example, CH 686,896 discloses a car park comprising a silo with radiating parking compartments at each level. The parking compartments at any particular level form an annulus. In the centre of the silo - within the annuluses - is a central shaft with a hoist for raising and lowering cars between the different levels, including ground level. Each car is either driven from the hoist into a vacant parking compartment or drawn from the hoist by mechanical means into the parking compartment.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a car park in which a higher parking density can be achieved in an alternative to existing approaches.

The present invention provides a car park comprising:

a plurality of annular parking levels;

an outer structure and a central core for supporting said parking levels; and

a hoisting mechanism;

wherein each of said plurality of parking levels comprises a plurality of parking compartments located between said outer structure and said inner core, each of said levels is rotatable to bring a respective compartment into alignment with said hoisting mechanism so that said respective compartment can be detached from said respective level and raised or lowered by said hoisting mechanism.

It will be understood that the car park of the invention can be used to park vehicles other than cars, and that the term "car park" is regarded throughout as synonymous with "parking garage."

Thus, it is not necessary to provide separate hoist platforms and parking compartments, as each parking compartment acts as necessary as a hoist platform.

In one embodiment the hoisting mechanism is arranged to raise or lower said compartments vertically. In another embodiment the hoisting mechanism is arranged to raise or lower the parking compartments in a spiral shaped lift well.

Thus, in the former of these embodiments each parking compartment is moved through the shortest distance between levels, but in the latter embodiment a reduced lifting force can be used by taking advantage of the mechanical advantage provided by employing a spiral motion.

The car park includes at least one entrance level at which cars may enter said car park and park on an available one of said parking compartments, whereby said available parking compartment (now occupied) is movable to a parking

location. This movement optionally includes either or both: rotation to engage said hoisting mechanism and upward or downward movement by means of said hoisting mechanism. This movement generally always includes rotation at a final parking level out of engagement with said hoisting mechanism to a final parking location.

The entry level can be at ground level at the bottom of an above ground car park, at ground level at the top of a substantially underground car park, or at an intermediate level of a car park (whether the car park is below ground, above ground or partially above and below ground). In addition, the car park need not be a free-standing structure. While it can be free-standing, an alternative embodiment has the car park incorporated into another structure (such as an office building). In this latter case, the outer structure of the car park may be or include portions of that other structure.

In one embodiment, the car park has multiple entrance levels so that cars may enter said car park more quickly. Preferably the car park exit corresponds with the car park entrance, but this need not be the case; for example, the car park exit could be located in a different level from the car park entrance so that a car can be moved through the exit for exiting while another car enters the entrance in anticipation of being moved to a suitable parking location.

In one embodiment, the car park includes a plurality of hoisting mechanisms.

Thus, for example, separate hoisting mechanisms could be located 180° apart; although this would generally reduce the number of parking compartments, it might be desirable where speed of vehicle entrance and exit is particularly important.

In another embodiment, at least some of the parking compartments are adapted to receive more than one vehicle.

Thus, especially where vehicles are parked with high frequency, more than one could be accommodated in or on a single parking compartment. This would allow, for example, two vehicles to park and be stored at the same time. In this embodiment, when one of such vehicles is desired, the other would also be moved to the exit level but simply returned with a new second vehicle (if there remains a high demand for parking), or returned to a parking location alone.

Preferably at least one drive segment is provided at each level for rotating said plurality of parking compartments.

Generally the drive segment (or drive platform) does not comprise a parking platform, and is therefore not - in use - removed from its respective level.

In one embodiment, said plurality of annular parking levels constitutes a first parking circuit and said car park includes at least one additional parking circuit comprising a further plurality of annular parking levels, wherein said first parking circuit and said additional parking circuit are coaxial.

The levels of the further (or outer) circuit may or may not be aligned vertically with those of the inner (or first) circuit.

The present invention also provides a storage facility, comprising:

a plurality of annular storage levels;

an outer structure and a central core for supporting said storage levels; and

a hoisting mechanism;

wherein each of said plurality of storage levels comprises a plurality of storage compartments located between said outer structure and said inner core, each of said levels is rotatable to bring a respective compartment into alignment with said hoisting mechanism so that said respective compartment can be detached from said respective level and raised or lowered by said hoisting mechanism.

Thus, the invention provides a storage facility for essentially any object.

Preferably each compartment includes or comprises a container adapted for the intended stored type of article or articles.

Thus, more than one type of article could be stored, and one or more types of container of suitable design for the intended articles.

Preferably at least one drive segment is provided at each level for rotating said plurality of storage compartments.

Generally the drive segment does not comprise a storage compartment, and is therefore not - in use - removed from its respective level.

In one embodiment, said plurality of annular storage levels constitutes a first storage circuit and said storage facility includes at least one additional storage circuit comprising a further plurality of annular storage levels, wherein said first storage circuit and said additional storage circuit are coaxial.

The levels of the further (or outer) circuit may or may not be aligned vertically with those of the inner (or

first) circuit.

BRIEF DESCRIPTION OF THE DRAWING

In order that the present invention may be more clearly ascertained, embodiments will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a car park according to an embodiment of the present invention;

Figure 2 is a cross-sectional view of the car park of figure 1 in use;

Figure 3A is a cross-sectional view of a parking platform of the car park of figure 1;

Figure 3B is a cross-sectional view of a parking platform engaged with the hoisting mechanism of the car park of figure 1;

Figure 3C is a schematic view of a parking platform engaged with the hoisting mechanism, comparable to figure 3B;

Figure 3D is a cross-sectional view comparable to figure 3B of a parking platform engaged with an alternative hoisting mechanism of the present invention;

Figure 4 is a schematic view of the hoisting and rotating mechanism of the car park of figure 1;

Figure 5 is a plan view of a filled level of the car park of figure 1;

Figure 6 is a plan view comparable to figure 5, illustrating the rotation of the levels shown in figure 5;

Figure 7 is a schematic view of the level of figure 6 illustrating the exiting of a car from that level;

Figures 8A to 8D are more detailed view of a single parking platform of the car park of figure 1;

Figure 9 is a schematic view of a level of a car park according to a further embodiment of the present invention; and

Figure 10 is a schematic view of the drive

platform of the level of figure 9.

DETAILED DESCRIPTION

A car park according to an embodiment of the present invention is shown generally at 10 in figure 1. In this embodiment, the car park 10 is an above-ground car park, though it will be appreciated that it could in some embodiments be partially or wholly below ground.

Car park 10 includes an inner core 12 and an outer supporting structure 14, and comprises a plurality of annular parking levels 16a, 16b, 16c, etc. Each level comprises a plurality of parking compartments in the form of parking platforms, each of which comprises a sector of a respective annular parking level and extending between inner core 12 and outer structure 14.

Car park 10 includes a vertical lift shaft 20, generally comprising vertically aligned gaps, one parking platform in width, in each of the parking levels 16a, 16b, etc.

In one alternative embodiment, the lift shaft has a spiral configuration in which the gaps are progressively offset around the vertical axis of the car park. This configuration has the advantage of reducing the lifting force required to raise vehicles.

In another alternative embodiment, each level is offset relative to its adjacent levels, so that the inner core is not vertical. The lift well in this embodiment is straight but slanted.

The overall dimensions of the car park can be chosen to suit the application (including expected vehicle size, etc), but in this embodiment the car park 10 has 21 parking levels, each with 17 parking platforms. The outer circumference of each level is approximately 69.2 m. The

height of the car park 10 is approximately 48 m.

The vertical separation 26 of the parking levels, when used for parking passenger vehicles, is approximately 2.2 m.

Figure 2 is an essentially cross-sectional schematic view of the car park 10, occupied by a number of cars 32. In use, each car is raised in lift shaft 20 on a parking platform 24 to the desired level, as will be described in greater detail below. Each of the parking platforms 18, 24 (of steel or reinforced concrete) has a thickness of approximately 0.2 m.

Each parking level 16a, 16b, etc. is rotatable, so that when parking platform 24 reaches the desired level, the level (including the parking platforms constituting that level and the just raised parking platform 24) is rotated so that the car being parked is moved out of the lift-well 20; an unoccupied parking platform is instead located in the lift-well 20. That unoccupied platform is then lowered to the entrance level ready to receive the next car. Alternatively, if a driver wishes to retrieve his or her car at the same time as another car is being parked, the car being parked can be raised to the same level as the desired car, after which that level can be rotated to bring the desired car into alignment with the lift-well so that the desired car can be lowered on its parking platform to the entrance/exit level (in this embodiment, ground level).

Detailed views of an individual parking platform are shown in figures 3A, 3B, 3C and 3D. Referring to figure 3A, each parking platform 30 is located between outer wall 14 and inner core 12. Each platform 30 and the other platforms at the same level are supported at their inner end by a principal inner bracket 32, which is itself

supported by inner core 12 and is continuous apart from a gap coinciding with lift-well 20. This gap allows the lifting mechanism to raise or lower parking platforms within the lift-well 20. Principal inner bracket 32 includes a horizontal slot 34 for accommodating the parking platforms 30. The outer end of each parking platform 30 is supported by a principal outer bracket 36 supported by outer wall 14 and including a slot 38 for receiving each parking platform 30. As with inner bracket 32, principal outer bracket 36 circles the entire car park 10, apart from a gap coinciding with lift-well 20.

Referring to figure 3B, the lift-well 20 (shown essentially in cross-section) can accommodate a single parking platform 40, raised or lowered by means of a hoisting or lifting mechanism. This mechanism includes inner lift bracket 42 and outer lift bracket 44 that are essentially identical in cross-section with principal inner bracket 32 and principal outer bracket 36 of each level. Brackets 42 and 44, however, have widths corresponding to the width of lift-well 20 at their respective locations. Lift brackets 42 and 44 retained and move in guides (not shown) in inner and outer walls 12, 14 and are raised or lowered by inner cables 46 and outer cables 48. The necessary lift can be provided by any suitable hoist located above the upper most level of car park 10.

This arrangement is shown more clearly, schematically, in figure 3C in which it can be seen how inner lift bracket 42 and outer lift bracket 44 can be lifted to coincide with principal inner bracket 32 (principal inner bracket 44) so that parking platform 40 (being raised or lowered) can be brought into coincidence with other parking platforms already at that respective level.

An alternative configuration to that shown in figure 3B is

shown in figure 3D. In this embodiment, the parking platform 40 and the bulk of the lifting mechanism is unchanged. However, the lifting mechanism is augmented by a rigid tie in the form of plate 45 joining inner lift bracket 42 and outer lift bracket 44. This plate 45 is located beneath the parking platform 40 and is of comparable width thereto, and serves to further fix inner lift bracket 42 and outer lift bracket 44 relative to each during raising and lowering of parking platform 40, particularly when carrying a vehicle. The plate 45 may also be provided with rollers or other comparable mechanisms to facilitate the sliding of each parking platform onto the lifting mechanism, particularly when loaded with a vehicle.

Optionally, the pairs of principal inner and outer brackets 32, 36 may also be provided with such a tie or ties, but as these brackets 32, 36 are not moved during the operation of the car park this is regarded as less important.

Figure 4 illustrates how the parking platforms at any single level are rotated so that a car that has been raised or lowered to that level can be moved out of the lift-well and into a parking location or, alternatively, how a parked car can be brought to a lift-well so that it can be lowered to the ground and exit level. As explained above, the lifting mechanism includes inner lift bracket 42, the lower portion of which is shown in figure 4. When raised or lowered by the lifting mechanism, this bracket 42 coincides with the principal inner bracket 32.

In figure 4 is shown a representative parking platform 50, whose inner end is exposed; in this figure the upper portion of inner bracket 32 is omitted for clarity (as is the upper portion of movable inner lift bracket 42).

Each parking level (such as the representative level shown in figure 4) is provided with a drive for rotating parking platforms at that level. Although any suitable mechanism may be used to rotate the parking platforms that form a respective level, in this embodiment a continuous driven belt 52 is employed, located within principal inner bracket 32. A second, comparable belt (not shown) is also employed, located within principal outer bracket 36. Each of these belts has teeth corresponding to teeth along the inner periphery and outer periphery respectively of each parking platform 50. Each belt is driven by means of a pair of drive wheels (for inner belt 52: drive wheels 54 and 56), provided in principal inner bracket 32 and principal outer bracket 36 respectively near the ends of the principal brackets adjacent the lift-well gap. Drive wheels 54 and 56 (and the corresponding drive wheels driving the outer belt) are driven by means of a suitable electric motor. The drive belts are only operated when the lifting mechanism is positioned such that lift brackets 42 and 44 and a parking platform 40 are aligned with that respective parking level.

If a car is to be removed, the drive belts rotate the now complete circuit of parking platforms until the desired car and its respective parking platform are located in lift-well 20. The lift mechanism is then used to lower that parking platform with its car to ground level. The empty parking platform is, in consequence, rotated into that level so that the net effect is that an occupied parking platform has been replaced with an unoccupied parking platform (though generally in a different location within the parking level).

If, on the other hand, a car is to be parked at that level, which includes an unoccupied parking platform, the raised parking platform 40 is initially occupied by the car to be parked, so the drive belts - when operated 0

rotate the parked car out of the lift well and continue to rotate until the unoccupied parking platform is located in the lift-well. This unoccupied parking platform can then be lowered by the lifting mechanism to the ground level to await the next car to be parked. Preferably, each level is left in a configuration where any unoccupied parking platforms are adjacent the lift-well so that, in such circumstances, a minimal amount of rotation is required in order to translate an unoccupied parking platform to the lift-well.

This procedure can be seen more clearly in figure 5, which illustrates a plan view of a full parking level 60 from which a car is to be retrieved. In this figure, inner wall 12 and outer wall 14 have been omitted for the sake of clarity.

Firstly, an empty parking platform 40 is raised by the lifting mechanism (including inner lift bracket 42 and outer lift bracket 44) to the level of parking level 60. At that point, inner lift bracket 42 and outer lift bracket 44 coincide, respectively, with principal inner bracket 32 and principal outer bracket 36. The drive belts (not shown) then rotate all the parking platforms of level 60 (including the unoccupied parking platform 40) until the desired car and its respective parking platform are in the lift-well. In this example, the desired car is car B and consequently, as this embodiment is configured so that each level is rotated clockwise when seen from above, level 60 is rotated through almost a complete circuit until car B and its supporting parking platform are aligned with the lift-well. This process is shown nearing completion in figure 6. It will be understood that principal inner bracket 32 and principal outer bracket 36 remain stationary: the parking platforms, driven by the drive belts, rotate within those brackets.

Referring to figure 7, when a car is to be parked at the car park, it enters at the ground level onto a empty parking platform, and is raised by lifting mechanism 62 in which there is at least one vacant parking platform 64. When the lifting mechanism has raised the platform 66 with car 68 to level 62 (as shown in figure 7) the parking platforms of level 62 are rotated until vacant parking platform 64 coincides with the lift-well and loaded parking platform 66 is out of the lift-well. At this point the car 68 can be regarded as having been appropriately parked, and the lifting mechanism can lower vacant parking platform 64 to ground level for receiving another car.

Referring to figure 8A, each of the parking platforms 70, as discussed above, is provided at its inner face 72 and its outer face 74 with teeth that engage the drive belts (the inner of which is shown at 52 in figure 4). Each platform 70 has a size suitable to receive a single (in this embodiment, private) vehicle such that the majority of vehicles can comfortably be accommodated. Referring to figure 8B, in this embodiment the radial length 76 of each platform 70 is approximately 5 m: the outer periphery 74 has a curved length of approximately 3.84 m, and the inner periphery 72 a length of approximately 2.1 m.

Referring to figures 8C and 8D, the upper surface 82 of each parking platform 70 is provided, at a distance 84 of approximately 1 m from its inner periphery 72, with a stop bump 86 (of height of approximately 0.1 m) to stop a car from driving too far towards inner periphery 72 and thereby colliding with the lifting mechanism, the inner core 12, etc. The upper surface 82 is also patterned to increase traction, at least in those regions 88 where a vehicle's wheels are located when parked on the parking platform 70. This patterning assists a vehicle's ability to brake when entering the parking platform, and to

commence exiting the parking platform when desired.

The car park is generally controlled centrally, so that a database is maintained of occupied and vacant parking platforms. Consequently, when a new vehicle enters the car park, the operation of the lifting mechanism and the rotation of the correct parking level can proceed essentially automatically. To maximise the speed with which a car is parked, the system will generally raise and rotate a new car to the lowest vacant parking platform. Once a car has been parked, as explained above each parking level is rotated so that any vacant parking platform is adjacent to the lift-well such that rotation of that respective level by one parking platform clockwise will move that vacant parking platform into the lift-well.

It may be advantageous to provide more than one exiting point for a car to exit, each situated around the exit level. In one embodiment, the driver re-enters the car (after its retrieval from some other level) and - while the driver preparing for departure - is rotated with the car to one of the plurality of exits.

Each of these exits in this embodiment is provided with a set of traffic lights, with at least red and green signals. If the driver is ready to exit, he or she can drive out when a green signal is given. If the signal returns to red before the driver is ready (indicating that the car will shortly be rotated further, perhaps owing to the arrival or exiting of another vehicle), the driver need only wait until his or her car has been rotated to the next of the plurality of exits.

As an alternative to the drive for rotating parking platforms at each level shown in figure 4, in a further embodiment of the invention the platforms at each level are instead driven by a drive platform. This platform is

similar to the parking platforms, except that it has an electric motor and - as it is not required to accommodate a vehicle - is narrower than the parking platforms. The parking platforms are pushed or pulled by the drive platform, as is described below.

Figure 9 is a schematic plan view of an annular parking level 90 according to this embodiment. The parking level 90, along with other like levels, is located (as in previous embodiments) between the inner core 92 and an outer supporting structure 94 of a multilevel car park.

The level 90 comprises a plurality of parking platforms 96 and a drive platform 98. These are all supported on a pair of concentric rails or tracks 100a, 100b laid around the level 90 apart from the gap 102 that, along with comparable gaps at other levels, define the lift shaft. (The first and second rails 100a, 100b are below the platforms 96, 98, but are shown in this figure for explanatory purposes.)

Figure 10 is a schematic view in cross section of drive platform 98. Drive platform 98 has two pairs of wheels (a first pair 104 being visible in this figure, joined by axle 106) that, in use, are located in rails 100a, 100b. The drive platform 98 also has an electric motor 108 that obtains power by suitable conventional means. This can be done, for example, by providing a live third rail between the first and second rails 100a, 100b. Drive platform 98 need have only three states of operation: stop, forward and reverse, and these can be effected by controlling the provision of power, or by communicating with a controller (not shown) provided on drive platform 98 by conventional means.

Vehicles are raised and lowered within the lift shaft essentially as described above, but on a parking platform

identical to parking platforms 96. However, this platform is raised and lowered on a hoist platform provided with further rail segments that, when aligned with level 90, allow the raised or lowered platform or one of platforms 96 to move from or onto the hoist platform.

Thus, in use drive platform is only activated when the hoist platform has been moved to level 90 and thereby completed the ring of platforms at level 90. Drive platform 98 is then activated to drive the complete circuit of platforms in the appropriate direction. This direction is determined according to whether a vehicle is being parked or retrieved. If a vehicle is being parked, the parking platform hoisted to level 90 will be laden and level 90 will already include at least one unladen parking platform 96. The drive platform 98 will rotate the platforms to move the unladen parking platform 96 nearest the lift shaft towards and into the lift shaft (and thereby onto the lift hoist platform). The lift can then lower the hoist platform with empty parking platform for collection of another vehicle.

If a vehicle is being retrieved, the lift raises an empty parking platform, then the drive platform 98 drives the circuit of platforms until the requested vehicle is in the lift shaft. The lift can then lower the hoist platform with parking platform and vehicle to the exit level.

It will be understood that the drive platform is only activated when an additional parking platform is located in lift shaft gap 102, so coupling between the platforms is unnecessary. Further, drive platform need not enter the gap 102, as it can be driven in both directions. However, it might be desirable to permit it to cross the gap 102 (while the hoist platform is at level 90) to reduce the time required to effect the required rotation of the platforms.

This embodiment provides a simpler drive mechanism for rotating the parking platforms, as only the drive platform 98 need be provided with a motor or, indeed, any drive mechanism. The parking platforms 96 are merely shunted into place as required by the drive platform 98.

In a further embodiment of the present invention, a multi-level car park is provided in which a plurality of concentric parking levels, each comparable to - for example - level 60 of figure 5 or level 90 of figure 9. A schematic view of such an arrangement is shown in figure 11, employing the drive mechanism shown in figures 9 and 10. Cars, according to the present invention, are not hoisted within a central core or outside the outer wall of the car park, but rather within a lift shaft defined with each level. Consequently, the addition of one or more further parking platforms arranged around an inner circuit of parking platforms need not impede the parking or retrieval of cars. Thus, referring to figure 11, inner circuit 90 of parking platforms 96 (with drive platform 98) are surrounded by further circuit 90' of parking platforms 96' (with drive platform 98'). Vehicles to be parked in or retrieved from the inner circuit 90 of parking platforms 96 are raised or lowered in lift shaft 110, while vehicles to be parked in or retrieved from the outer circuit 90' of parking platforms 96' are raised or lowered in lift shaft 110'.

In this embodiment, different entry levels are used for each circuit of parking platforms.

Modifications within the scope of the invention may be readily effected by those skilled in the art. It is to be understood, therefore, that this invention is not limited to the particular embodiments described by way of example hereinabove.

It should be understood that references herein to prior art are not intended to suggest that any such prior art is common general knowledge.

Dated this 27th day of June 2003

JIONG LYENA LI

By her Patent Attorneys

GRIFFITH HACK

Fellows Institute of Patent and

Trade Mark Attorneys of Australia

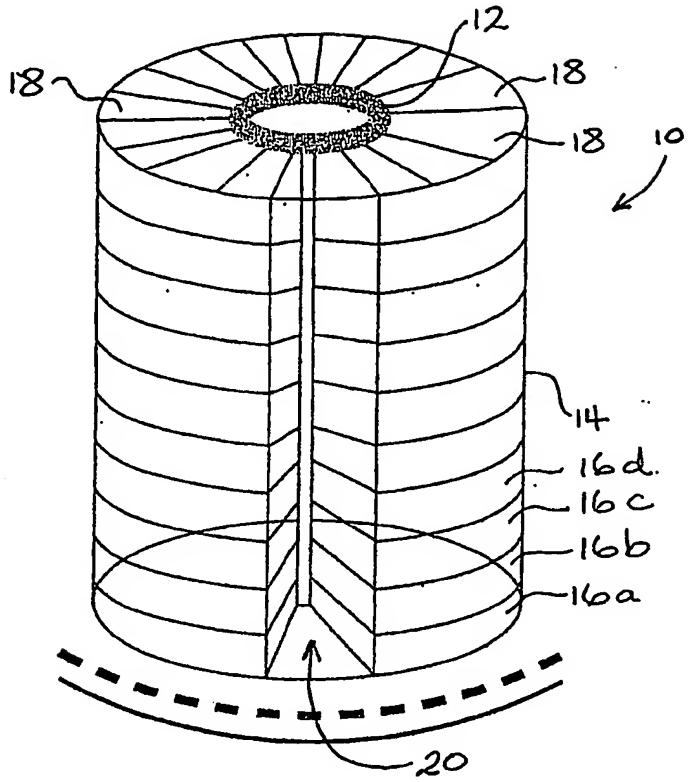

FIGURE 1

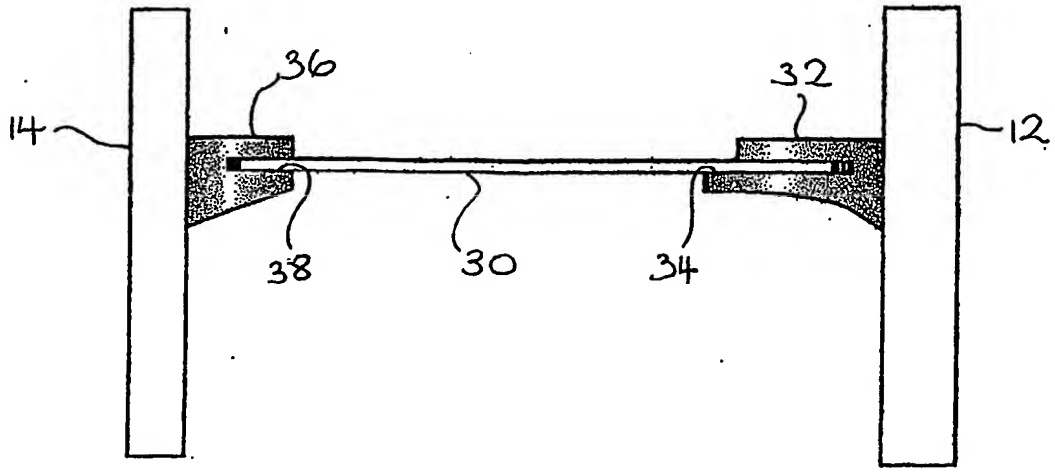

FIGURE 3A

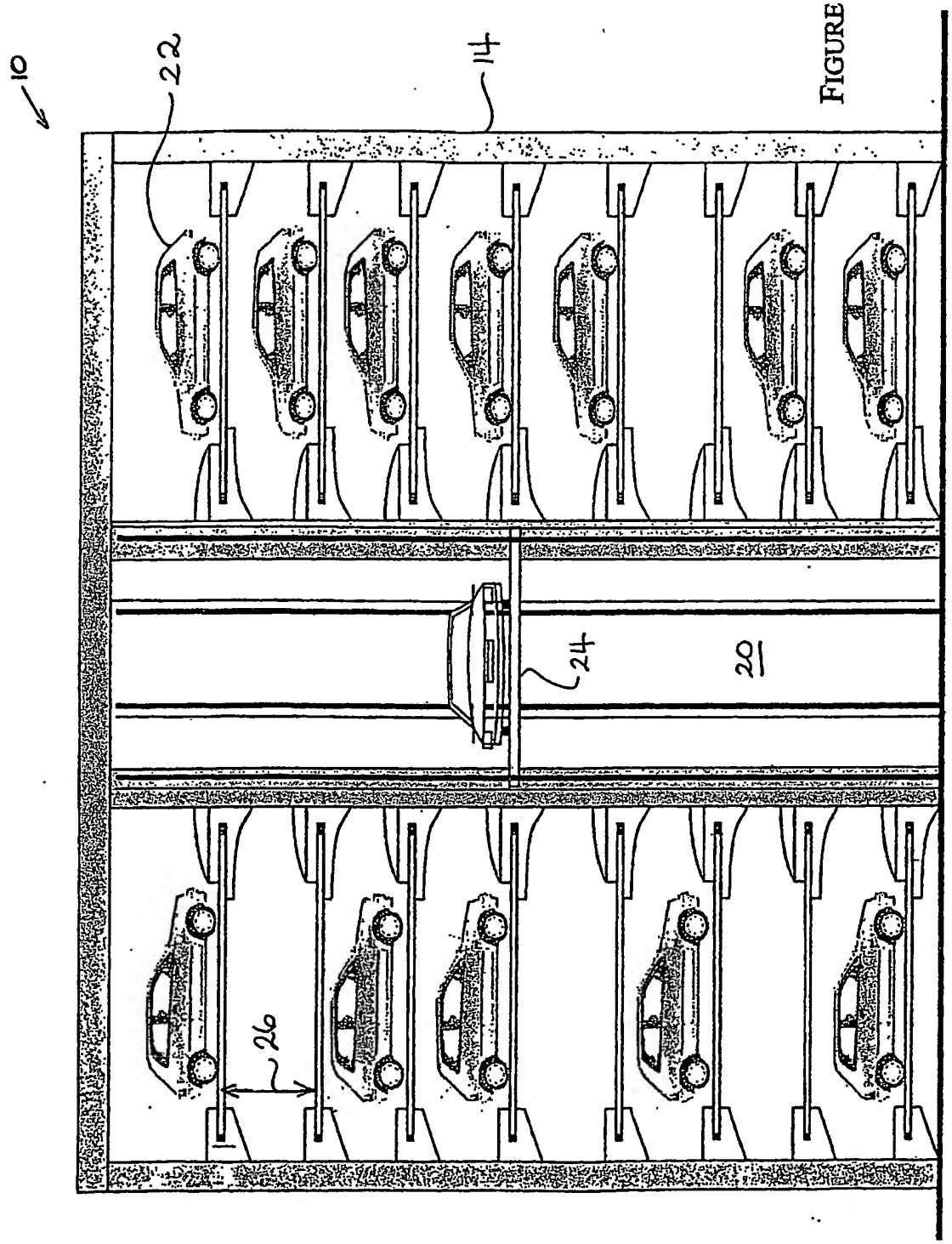

FIGURE 2

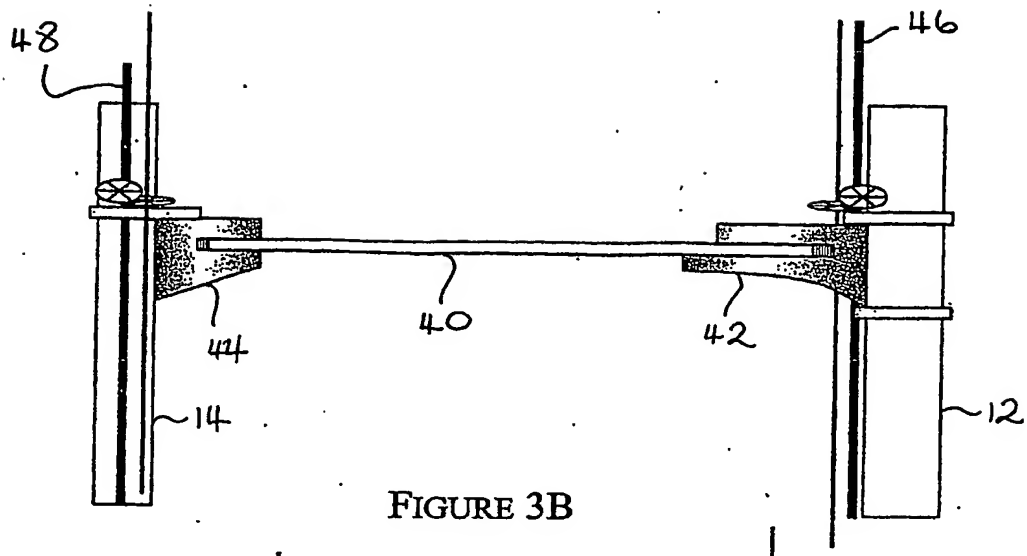

FIGURE 3B

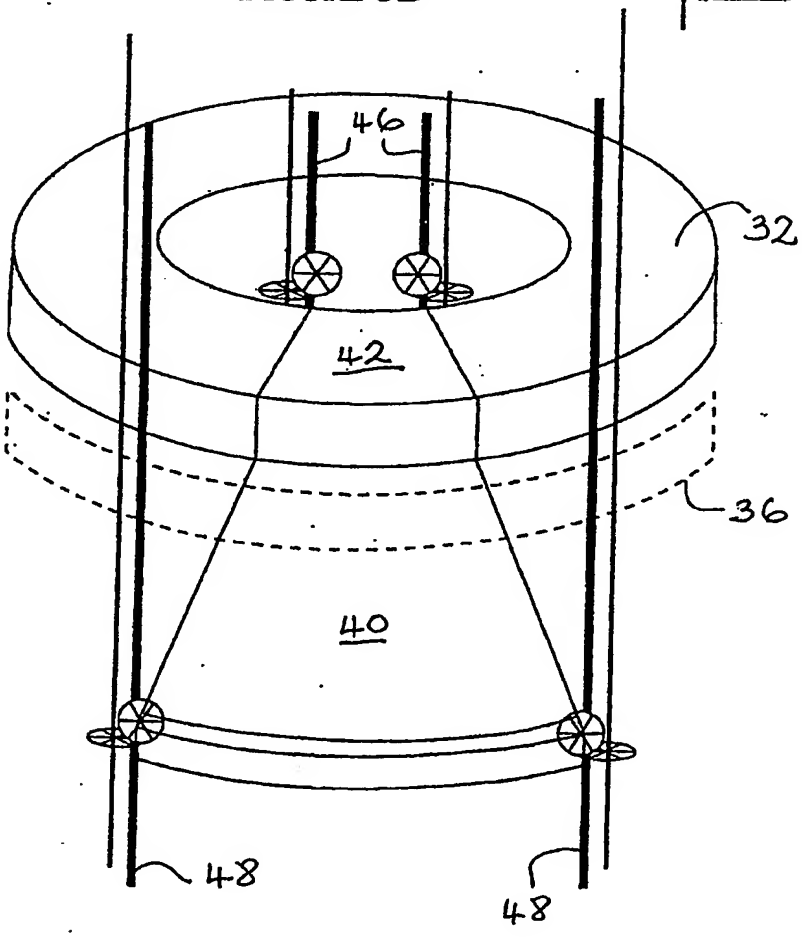

FIGURE 3C

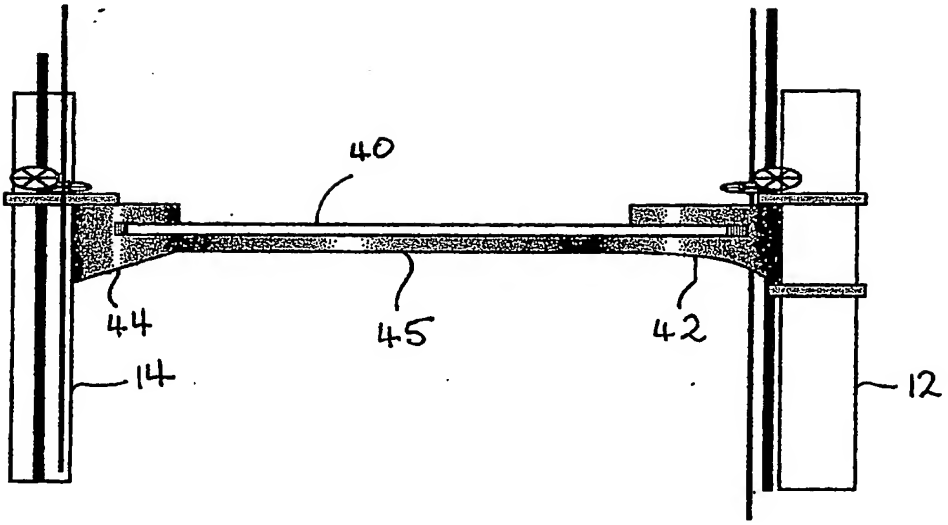

FIGURE 3D

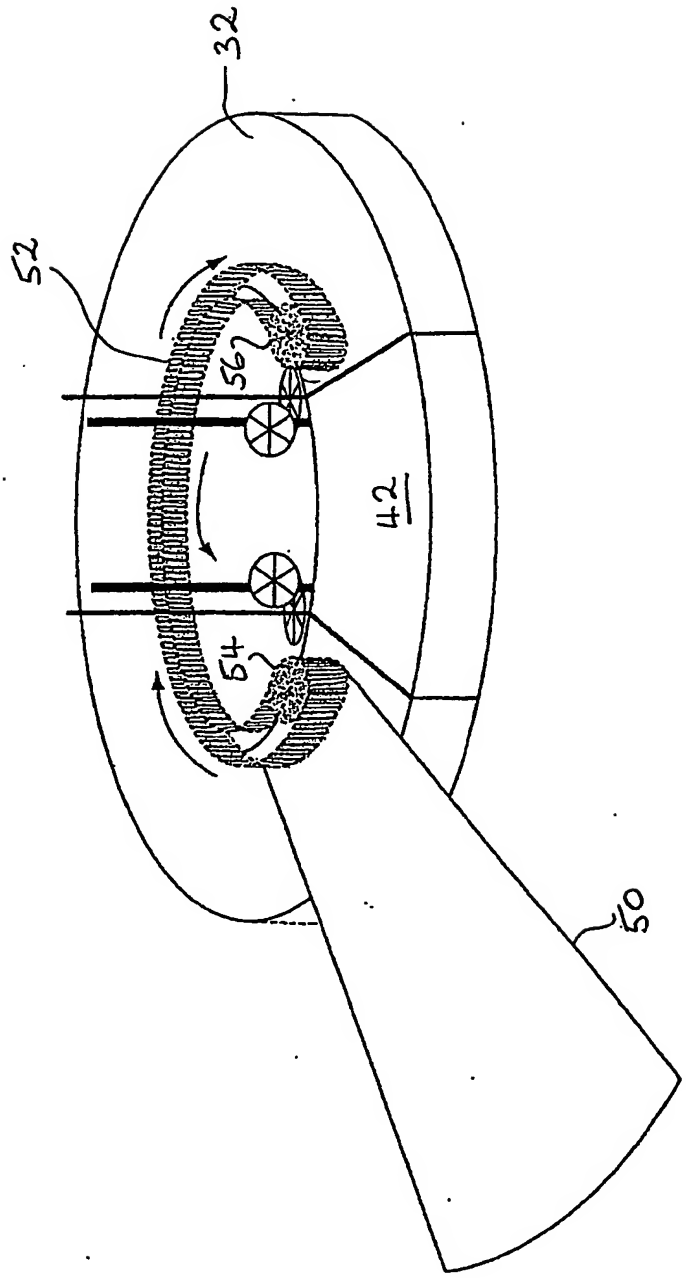

FIGURE 4

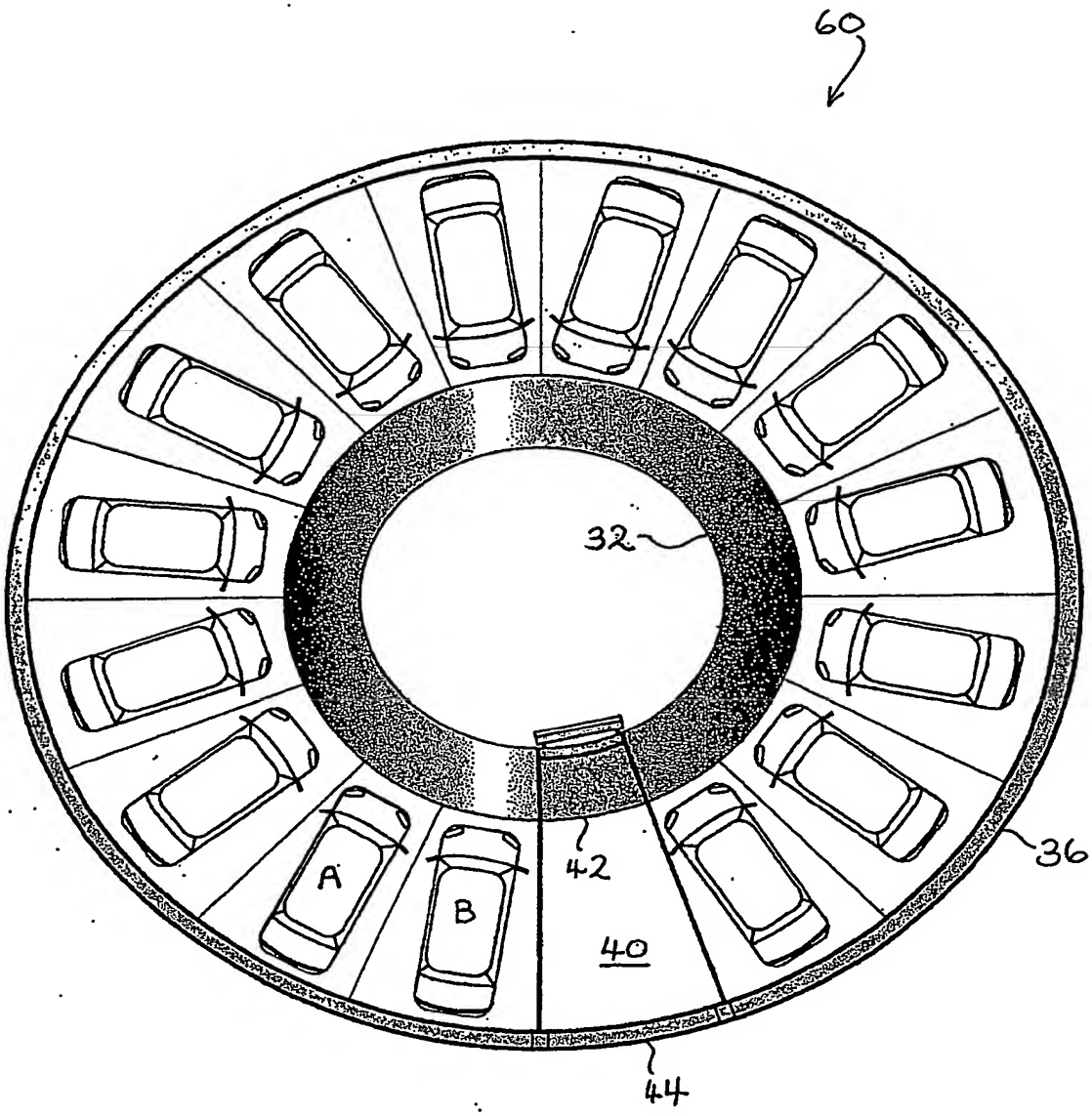

FIGURE 5

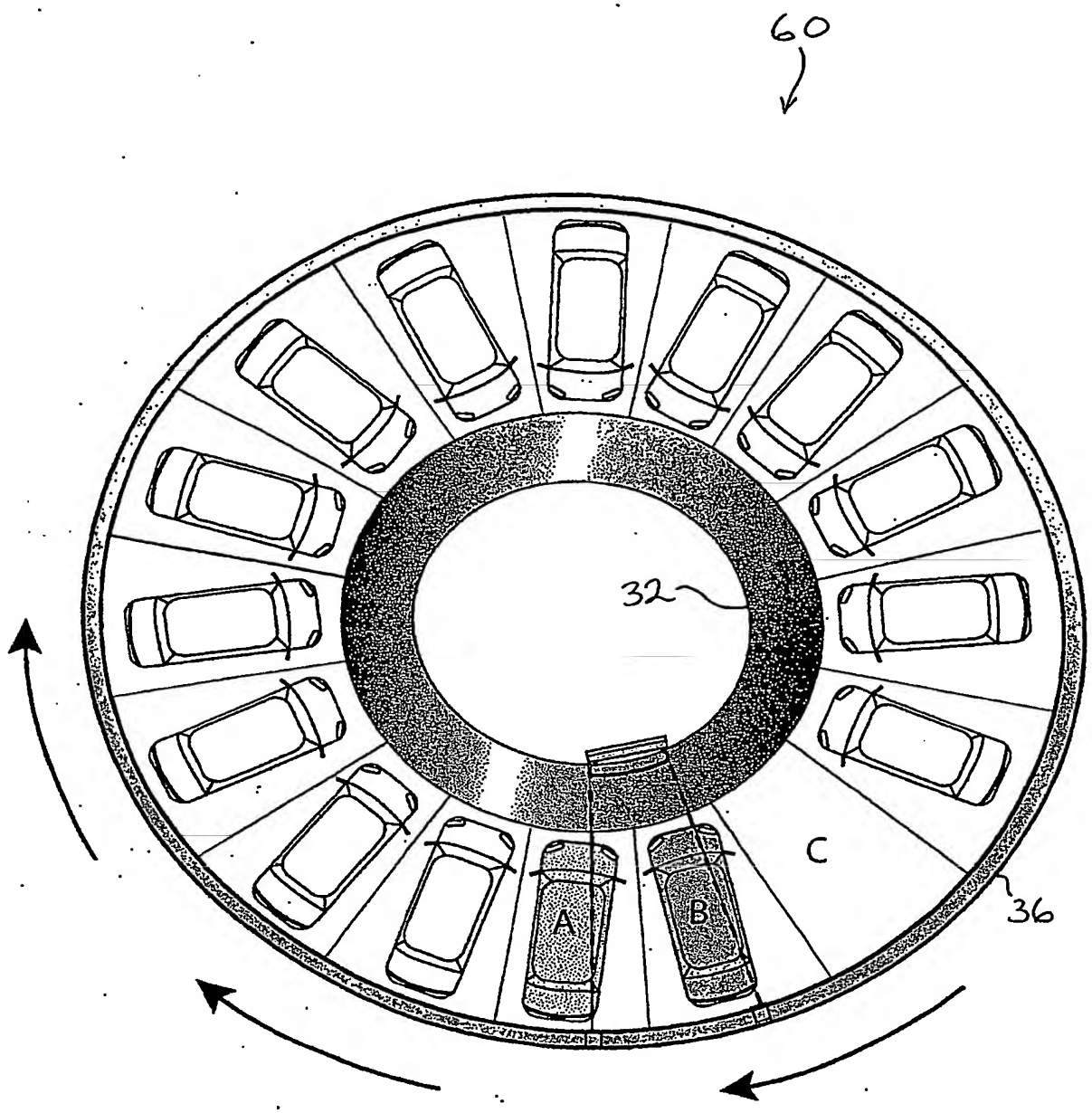

FIGURE 6

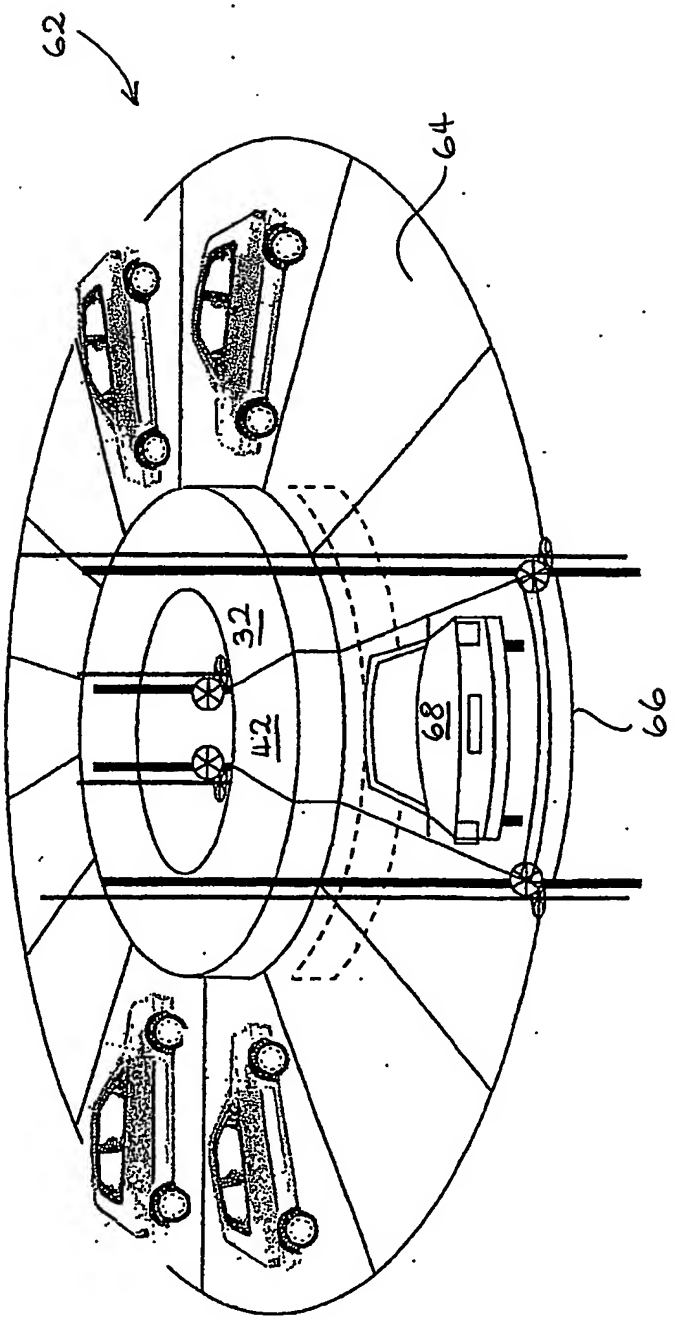

FIGURE 7

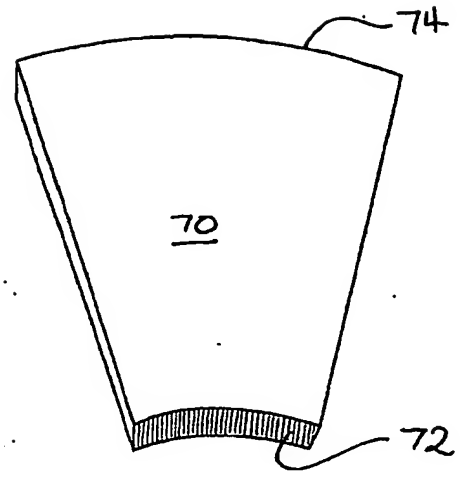

FIGURE 8A

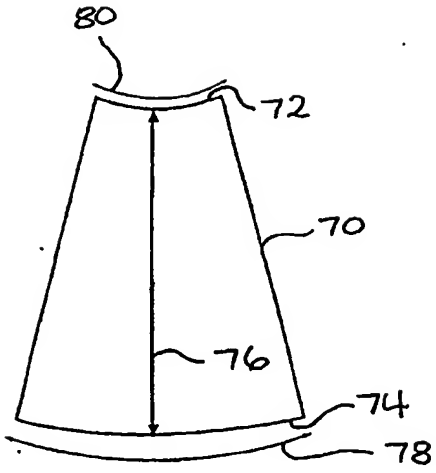

FIGURE 8B

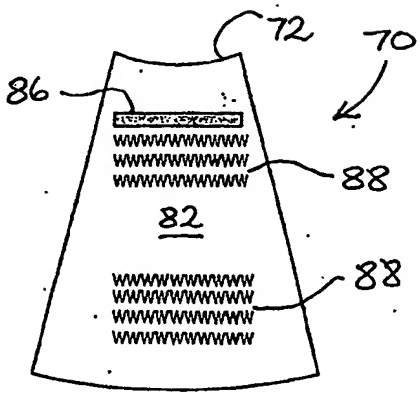

FIGURE 8C

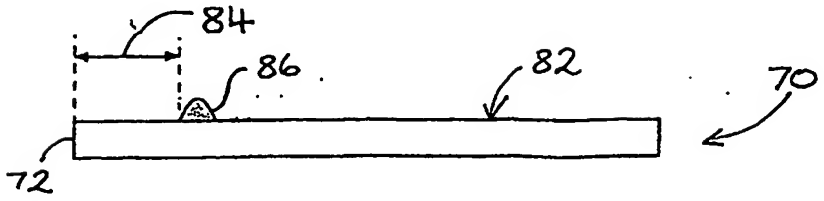

FIGURE 8D

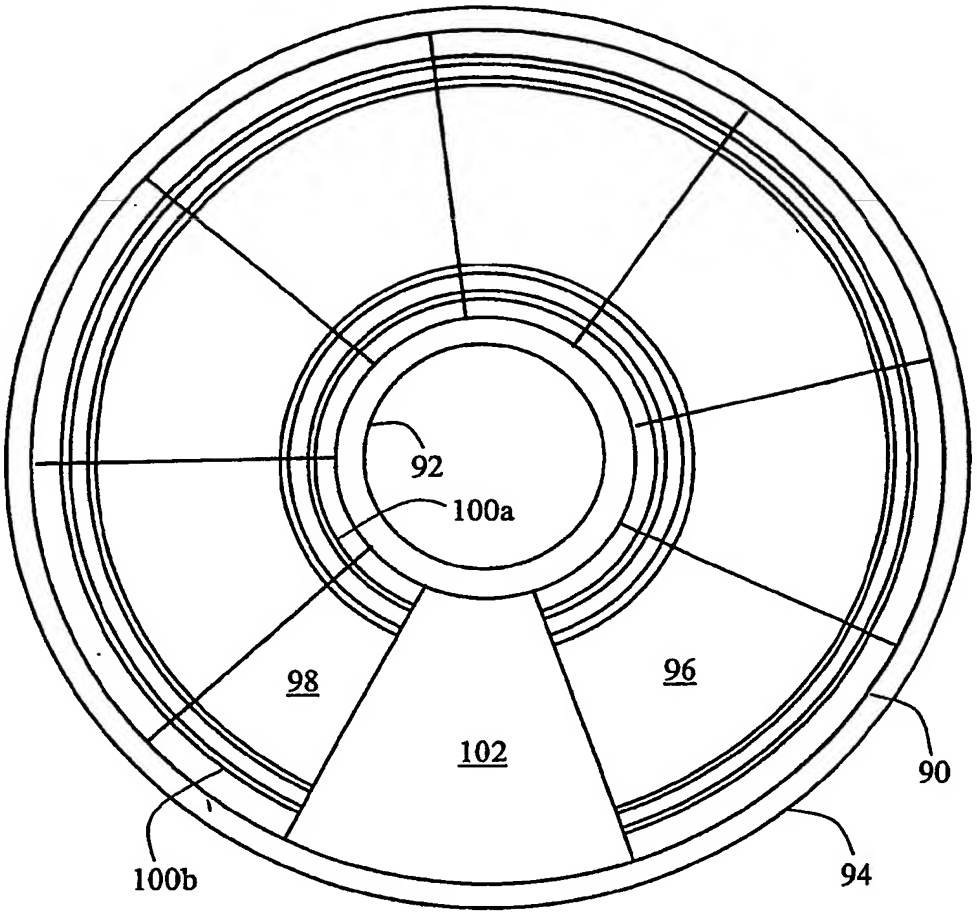

Figure 9

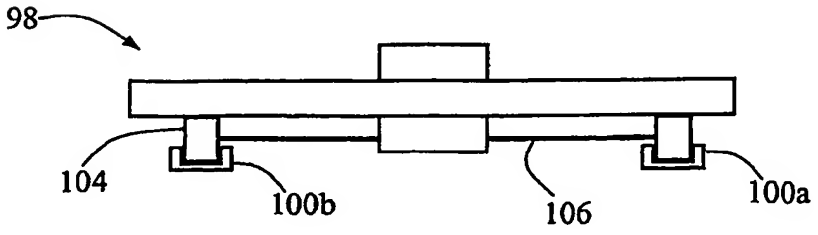

Figure 10

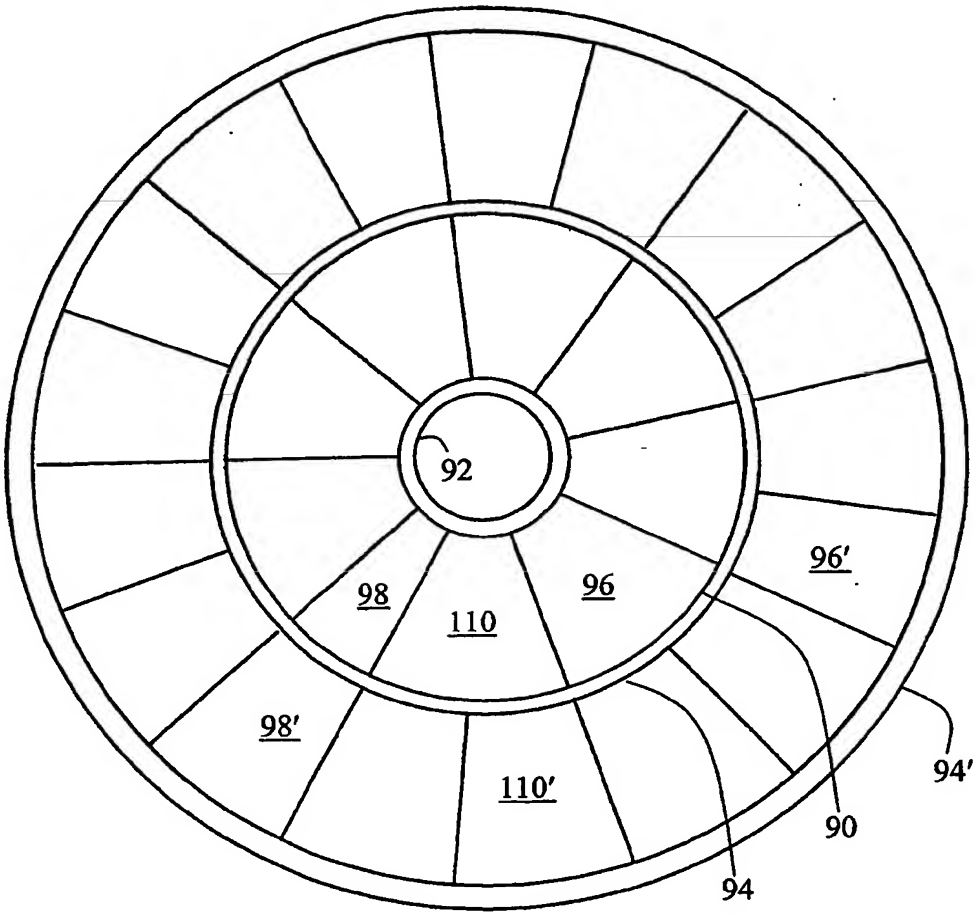

Figure 11